

Seattle University

ScholarWorks @ SeattleU

Projects Day Booklets

College of Science & Engineering

2014

2014 Projects Day Booklet

Seattle University

Follow this and additional works at: <https://scholarworks.seattleu.edu/projects-day>

Recommended Citation

Seattle University, "2014 Projects Day Booklet" (2014). *Projects Day Booklets*. 30.
<https://scholarworks.seattleu.edu/projects-day/30>

This Book is brought to you for free and open access by the College of Science & Engineering at ScholarWorks @ SeattleU. It has been accepted for inclusion in Projects Day Booklets by an authorized administrator of ScholarWorks @ SeattleU.

SEATTLEU



JUNE 6, 2014 // SULLIVAN HALL

SEATTLE UNIVERSITY PROJECT CENTER

PROJECTS DAY 2014



REAL PROJECTS REAL WORLD

The Seattle University Project Center is pleased to partner with businesses, government agencies and nonprofit organizations regionally and nationally to bring hands-on projects to our students. Student teams from the College of Science and Engineering and the Albers Schools of Business and Economics work on projects in the fields of civil and environmental engineering, computer science and software engineering, electrical and computer engineering and mechanical engineering, as well as marketing, management, financial analysis, economics, international business, sustainable business and new business ventures.

Our students graduate with real-world experience in their fields, along with invaluable teamwork and communication skills that place them ahead of their peers. Projects Day is the culminating event of the Project Center experience for the students, as well as an opportunity to thank Project Center sponsors and faculty. This event also offers an introduction to the Project Center program for potential sponsors.

WELCOME MESSAGES



Welcome to Projects Day 2014! We are glad that you are here to join the celebration. Today, you'll see for yourself what employers already know: our graduates have a strong understanding of fundamental principles and are excellent communicators. We are able to achieve these enviable results here at Seattle University because we keep our class sizes small, we give our students lots of rigorous homework and we ask them to make presentations often. Capping it all off is the Project Center experience, where our seniors work in teams, engage with external organizations and apply the engineering skills they've learned to "real-world" projects. It's clear that companies like what they see in Seattle University engineering and computer science students, because many of our graduates take full-time positions with the companies that sponsored their senior projects.

We are proud of our students and what they have accomplished. I encourage you to look through this booklet, identify some projects of interest and attend the team presentations. If you have a question, fire away! I'm confident you'll be impressed with the ability of our graduates to think on their feet and talk about technical issues. The Project Center is one of the jewels in the crown of the College of Science and Engineering.

I want to thank the project mentors and the faculty advisors who have worked with the teams throughout the academic year. Most especially, I want to acknowledge the institutional sponsors who make it possible for us to provide our students with this terrific educational experience. Thanks to generous support from our sponsors, we've created a strong tradition of excellence that will continue to serve our students, our partners and the workforce needs of the State of Washington.

Michael J. Quinn, Ph.D.
Dean, College of Science and Engineering



On behalf of the Albers School of Business and Economics, I want to welcome you to Seattle University's Projects Day 2014.

Like Science and Engineering students, Albers business students undertake real-world projects as part of their programs. Their experiential learning comes in the form of consulting, market research, and various other business projects for organizations such as Costco Wholesale, Glass Distillery and many more. Sponsors want to solve problems, identify new processes and target opportunities for growth. Albers MBA

students, working in teams with faculty oversight, deliver top-notch findings and recommendations to the company.

While these projects have been part of the Albers MBA curriculum for many years, the Albers connection to the Project Center began in 2008 when the two schools agreed to collaborate as one central point for building partnerships linking Seattle University with businesses, government agencies and nonprofit organizations throughout the Puget Sound region. We look forward to continuing cooperation between the schools and our community partners.

The business projects you will be seeing were undertaken in our International Business and New Ventures and Consulting classes. These projects represent over 20 that have been completed at Albers during this academic year.

Thank you for your support for these projects. Enjoy learning about them and getting to know the students involved.

Joseph M. Phillips, Ph.D.
Dean, Albers School of Business and Economics

SCHEDULE



11:45 AM – 12:30 PM

Check-in and Registration
Sullivan Hall, SU Law School

12:30 – 12:45 PM

Welcome to Projects Day 2014
Sullivan Hall, SU Law School

12:45 – 1:45 PM // PRESENTATION SESSION 1 // SULLIVAN HALL, SU LAW SCHOOL

ROOM C5

CEE 14.5 SNOHOMISH COUNTY PUBLIC WORKS Trout Creek Bridge #603 Replacement
CEE 14.2 TETRA TECH, INC. City of Vernonia Wastewater Treatment Building Structural Design
CEE 14.3 SEATTLE CITY LIGHT Seismic Evaluation of the Canal Substation Control Building

ROOM C6

ME 14.1 LIGHTHOUSE FOR THE BLIND De-burr of Canteen Cups
ME 14.2 BROOKS RAND LABS Design of a Portable and Automated Mercury Vapor Detection System
ME 14.3 KENWORTH TRUCK COMPANY Electrified Cooling Fan

ROOM 109

CSSE 14.1 WASHINGTON STATE DEPARTMENT OF LICENSING Point in Time Driver Record Status Access
CSSE 14.2 MERCENT CORP. Local Shopping Support
CSSE 14.3 PEMCO Direct Our Donation - Community Website

ROOM 110

ECE 14.1 ALSTOM GRID Load and Voltage/VAR Management (LVM) and Advisory Plans via iPad Application
ECE 14.2 SNC-LAVALIN Protective Relay - Plant DCS IEC 61850 Communication Verification
ECE 14.3 SEATTLE CITY LIGHT Comparison of Communications-based Line Relaying Schemes for Microprocessor Relays

1:45 – 2:00 PM

Break

ROOM C5

CEE 14.6 KING COUNTY WATER AND LAND RESOURCES DIVISION River and Floodplain Management Section North Fork Snoqualmie Hazards Analysis and Restoration

CEE 14.1 SEATTLE PUBLIC UTILITIES Tidal Impacts on Wastewater Pump Stations and CSO Facilities

CEE 14.4 KENNEDY/JENKS CONSULTANTS Coffee Wastewater Treatment in San Antonio, Nicaragua

ROOM C6

ME 14.4 MICROSOFT Universal Mount for Xbox One Kinect

ME 14.5 THE BOEING COMPANY Quick Attach Clevis and Adjustable Tie Rod

ME 14.6 THE BOEING COMPANY Reactive Aircraft Partition Mounting System

ROOM 109

CSSE 14.4 PHILIPS MEDICAL Systems Ultrasound Exam Data Router

CSSE 14.5 SAGE BIONETWORKS Interactome: Exploring Social Connections in Scientific Research

CSSE 14.6 SDL | SOCIAL INTELLIGENCE Social Intelligence Workflow Manager

ROOM 110

ECE 14.4 SEATTLE UNIVERSITY Muhuru Bay Community Microgrid

ECE 14.5 HONEYWELL eHHDLU Troubleshooting Aid

ECE 14.6 PACCAR INC. Lane Changing Collision Avoidance System

3:00 – 3:15 PM

Break

3:15 – 4:15 PM // PRESENTATION SESSION 3 // SULLIVAN HALL, SU LAW SCHOOL

.....

ROOM C6

ME 14.7 ELECTROIMPACT Carbon Fiber Re-spooling System

ME 14.8 SEATTLE UNIVERSITY AND MCKINSTRY CO. Bellarmine Central Hot Water System Comprehensive Plan

ME 14.9 NATIONAL PARK SERVICE Upgrade Longmire Roads Garage for Higher Energy Efficiency

ME 14.10 HINDS-BOCK Articulating Spout

ROOM 110

ECE 14.7 CITY INTELLIGENT SYSTEMS, INC. Business Intelligence for Smart Grid Energy Dashboard

ECE 14.8 PACIFIC NORTHWEST NATIONAL LABORATORY Microgrid Simulation Model and Tools

ECE 14.9 GRAKON Data-logging Lamp

ROOM 105

MBA 14.1 POWDER HOUND CUSTOMS

MBA 14.2 TATOOSH CRAFT DISTILLERY

4:15 – 5:00 PM

Poster Session

5:00 – 6:00 PM

Reception

6:00 – 7:00 PM // MASTER OF SOFTWARE ENGINEERING PRESENTATION SESSION SULLIVAN HALL, SU LAW SCHOOL

.....

ROOM 105

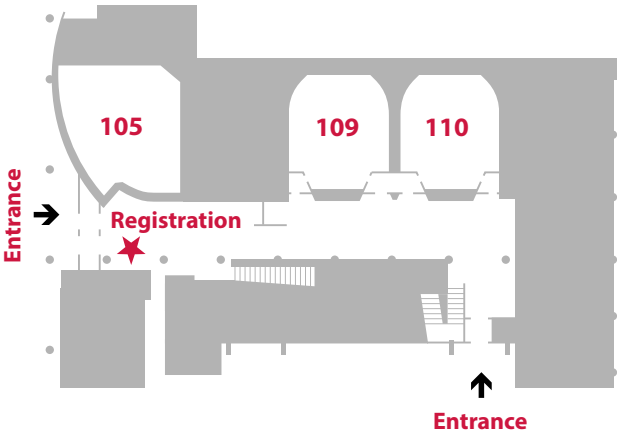
MSE 14.1 ASTRONICS SAVORY Framework

MSE 14.2 COSTCO Costco Team Concert

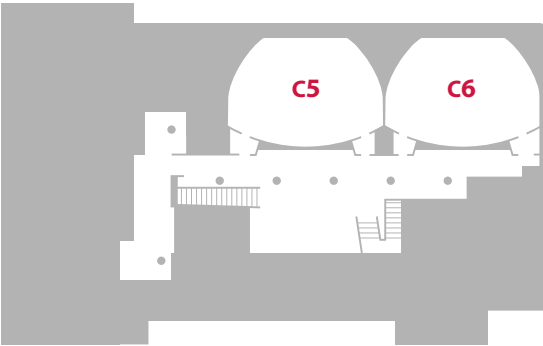
MSE 14.3 SNOHOMISH COUNTY PUBLIC UTILITIES DEPARTMENT Energy Resource Analytics

SULLIVAN HALL MAP

MAIN LEVEL



LOWER LEVEL



PROJECTS



CIVIL AND ENVIRONMENTAL ENGINEERING

CEE 14.1 // TIDAL IMPACTS ON WASTEWATER PUMP STATIONS AND CSO FACILITIES SPONSOR: SEATTLE PUBLIC UTILITIES

SPONSOR LIAISONS: George Schneider, PE, James Rufo-Hill, Corinne DeLeon, PE

FACULTY ADVISOR: Prof. Phillip Thompson, PE

STUDENTS: Justin Barnes, Gabrielle Lefebvre, Codee Samala-Passos



Seattle Public Utilities (SPU) asked senior design team CEE 14.1 to investigate the impacts of climate change-driven sea level rise (SLR) on its wastewater pump stations (WWPS) and combined sewer overflow (CSO) facilities located along Puget Sound. These facilities are vulnerable to a loss of functionality during extreme high tide and storm surge events. Climate change-driven SLR is predicted to lead to an increased severity and frequency of seawater inundation, an increased frequency of overflows, increased power and treatment costs and accelerated equipment corrosion. Higher tides could prevent CSO facilities from discharging as designed, increasing the potential for sewer back-ups for customers. CEE 14.1 identified 18 WWPS and 20 CSO facilities that are potentially vulnerable to the impacts of SLR. To develop impact mitigation strategies, first the team prioritized these facilities according to the urgency and severity of the predicted impacts. Then they provided design options to mitigate these impacts, along with an economic analysis evaluating the cost of proposed designs and the cost of inaction. Finally, CEE 14.1 developed an approximate timeline to guide the implementation of the mitigation designs.

CEE 14.2 // CITY OF VERNONIA WASTEWATER TREATMENT BUILDING STRUCTURAL DESIGN

SPONSOR: TETRA TECH, INC.



SPONSOR LIAISONS: Hamid Naderi, PE, Tim Tipton, PE, Ryan Maas, PE

FACULTY ADVISOR: Prof. Nathan Canney, PE

STUDENTS: Jane Johnson, Aleksey Koshman, Dylan LaRose, Blake Rassilyer

Vernonia is a small city located in Northwestern Oregon and is home to approximately 2,400 residents. Due to a projected population increase, the current wastewater treatment facility required capacity improvements to provide for the increase in demand. As a result, the city contracted Tetra Tech to design an expansion building to house an additional pump station for use by the facility. Tetra Tech tasked senior design team CEE 14.2 with the structural design of a single-story, concrete masonry (CMU) building with a monoslope roof. The team used respective design codes, in accordance with the 2012 International Building Code (IBC 2012), to design the structural elements of the building, including roof decking and joists, CMU wall reinforcement, mat foundation and reinforcement and an interior steel platform. The final report provided to Tetra Tech included a fully detailed design package that included calculations and drawings of the building components.

CEE 14.3 // SEISMIC EVALUATION OF THE CANAL SUBSTATION CONTROL BUILDING

SPONSOR: SEATTLE CITY LIGHT



SPONSOR LIAISON: Robert Cochran, PE, SE

FACULTY ADVISOR: Prof. Katherine Kuder, PE, Prof. Jhon Paul Smith, PE

STUDENTS: John Anderson, Randal Anton, Keisuke Massey, Garrett Skelton

The Canal Substation Control Building is a three-story, reinforced concrete structure constructed in 1927, with additions completed in 1943. The building, located in Seattle, WA, is one of fourteen substations owned and operated by Seattle City Light (SCL) that are being subjected to their Seismic Hazard Reduction Program to ensure adequate performance under a major earthquake. Because the structure was designed and built before rational seismic provisions existed, it is vulnerable to damage or collapse during an extreme earthquake. The structure is approximately 13,000 square feet and houses critical equipment that distributes power throughout the neighborhoods of Ballard and Wallingford, making it important that the structure remain operational following an earthquake. CEE 14.3 assessed the seismic vulnerability of the building based on the American Society of Civil Engineers Standard for Seismic Evaluation of Existing Buildings (ASCE 31-03). This involved a two-tier procedure that started with completing a checklist, followed by a more detailed analysis. After completion of this analysis, the team provided conceptual mitigation ideas to address the structural deficiencies. The team's final report to SCL contained a list of structural deficiencies, mitigations alternatives, supporting calculations, preliminary drawings and cost estimates.





CEE 14.4 // COFFEE WASTEWATER TREATMENT IN SAN ANTONIO, NICARAGUA

SPONSOR: KENNEDY/JENKS CONSULTANTS **Kennedy/Jenks Consultants**

SPONSOR LIAISONS: Michael Norton, PE, Tom Keown, PE, Chris Stoll

FACULTY ADVISOR: Prof. Michael Marsolek

STUDENTS: Karl Clocksin, Bobbie Gilmour, Brandon Moss

Coffee is the principal export of Nicaragua, exceeding \$200 million each year. Harvesting and processing coffee produces wastewater that is over eleven times more concentrated in organics than domestic sewage and contains four times more nitrogen and phosphorus. In this project, Kennedy/Jenks Consultants (KJ) selected team CEE 14.4 and our collaborators at the University of Central America – Managua (UCA) to design a wastewater treatment system for a small farm in San Antonio, Nicaragua. The farm currently operates without a treatment system, and the wastewater it produces flows into nearby surface waters, polluting them for downstream users. The team designed a settling tank, filtration process and nutrient removal process to meet Nicaraguan standards. Design work included laboratory testing and on-site field measurements generated by our UCA partners, highlighting the collaborative nature of the project. The design used appropriate technologies for wastewater treatment that have low maintenance, low costs and a small footprint. The team's goal is for this design to serve as a template for other local farmers to install sustainable wastewater treatment systems.

CEE 14.5 // TROUT CREEK BRIDGE #603 REPLACEMENT

SPONSOR: SNOHOMISH COUNTY PUBLIC WORKS

SPONSOR LIAISON: Steven Miller, PE

FACULTY ADVISOR: Prof. Nathan Canney, PE

STUDENTS: Daniel Carr, Khai Le, Trung Le, Shin-Wei (Steve) Liu



Snohomish County performs routine reviews of their infrastructure, and recent inspections have shown Trout Creek Bridge #603 is compromised by rot, which generates ongoing maintenance. The 19 foot span timber bridge is located 10 miles east of Granite Falls, WA, and serves a small residential community on the banks of the South Fork Stillaguamish River. By replacing the bridge, the County can install a durable, low-maintenance structure suited to the community and the environment. Team CEE 14.5 prepared a Type, Size, and Location (TS&L) Report for Snohomish County that included critical background research about the site and its challenges, as well as a preferred alternative that addressed County needs. As part of the report, the team developed a suggested road alignment, provided recommendations on how to address flood issues and scour hazards to the bridge, developed the structural design of three bridge alternatives and included preliminary cost estimates to support determination of the preferred alternative. With the information in this report, the County will be able to proceed with a 30% design.

CEE 14.6 // NORTH FORK SNOQUALMIE HAZARDS ANALYSIS AND RESTORATION
SPONSOR: KING COUNTY WATER AND LAND
RESOURCES DIVISION, RIVER AND FLOODPLAIN
MANAGEMENT SECTION



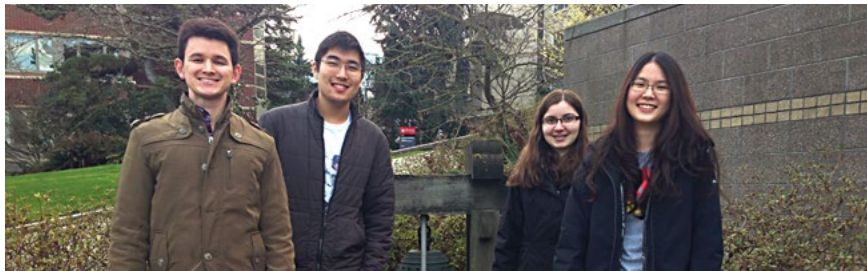
SPONSOR LIAISONS: Clint Loper, PE, Mary Lear, PE, Mark Ruebel, PE

FACULTY ADVISOR: Prof. Jhon Wesley Lauer, PE

STUDENTS: Nicole Nagao, Jon Polka, Matthew Thomas

King County's Department of Natural Resources and Parks, Rivers and Floodplain Management Section (the County) is sponsoring a hazards analysis and restoration planning project for an approximately one-mile long stretch of the North Fork Snoqualmie River near North Bend, WA. Bank erosion has damaged two levees, increasing flood risk and altering the direction of flow through a downstream bridge. This has led to scour near one of the bridge abutments, which in turn could lead to structural problems. The County selected CEE 14.6 to characterize the geomorphic processes and channel migration hazards in the area and to develop a set of conceptual design alternatives for mitigating the hazard. In collaboration with two Seattle University biology students, the team analyzed hydrology at nearby stream gages, historic channel migration in the reach and rates of sediment accumulation. Based on this analysis, the team developed a working computer model capable of simulating in-channel hydraulics and channel geomorphic change. The analysis forms the basis for several strategies for managing bank erosion and flood hazards in the reach. The final project deliverable included a no-action alternative and several conceptual designs that incorporated adaptive management at the site.





CSSE 14.1 // POINT IN TIME DRIVER RECORD STATUS ACCESS

**SPONSOR: WASHINGTON STATE
DEPARTMENT OF LICENSING**



SPONSOR LIAISON: Brent Rathgeber

FACULTY ADVISOR: Prof. Jeffrey Gilles

STUDENTS: Parks Barnard, Kevin Das, Emily Gehman, Katherine Langcaon

The Washington State Department of Licensing is developing a new system, called DOLLI, for accessing driver license data. The team was asked to create a new tab within DOLLI to allow users to access a full driver license record as it would have appeared at a user-specified point in time. The team designed a new service to filter record data from a history database and return a complete driver license record as it would have appeared to the user if the query had been executed at the user-specified point in time. The team created a new tab that integrated seamlessly into the DOLLI system, and matched the existing layout and interface design.

CSSE 14.2 // LOCAL SHOPPING SUPPORT

SPONSOR: MERCENT CORP.



SPONSOR LIAISONS: Chris Farah, Hans Ravnaas

FACULTY ADVISOR: Prof. Ben Tribelhorn

STUDENTS: Michael Buetow, Sophie Dankel, Alice Vichitthavong, Bang (Tony) Vien

Mercent builds eCommerce marketing software for online retailers. They collect retailer data and distribute it to many online channels, including Google. They asked the team to write an application interface (API) for use by local retailers to transfer local store, product price and inventory information to Mercent's databases. Mercent will then send the information on to Google, after which it will be displayed in a convenient GUI for the retailer. This user interface will allow retailers to view their local data conveniently within the same web app that they access with their Mercent account. This will be a useful tool for retailers and will benefit millions of consumers all over the country by making available accurate and timely shopping data.

CSSE 14.3 // DIRECT OUR DONATION - COMMUNITY WEBSITE **SPONSOR: PEMCO INSURANCE**



SPONSOR LIAISON: Kari Wittgens and Michelle Sievers

FACULTY ADVISOR: Prof. Yingwu Zhu

STUDENTS: Winthrop Bangasser, Nikolas Besagno, Wade Gushikuma, Justin Russell

PEMCO donates to a number of non-profit organizations each year and was looking for a way to involve their customers in helping to decide where to direct these funds. They asked team CSSE 14.3 to create a website that allows non-profit organizations that are working with PEMCO to post information about their current funding campaigns. Then, people will be able to vote on what they feel are the most deserving funding campaigns, and the winning organizations will receive PEMCO donations. Our objective was to create a website with two main components - administration and community. The administration component will manage campaigns (create, update, etc.) and monitor campaign voting. The community side will allow viewing and voting for campaigns. The ultimate goal of the website is to help strengthen the bond between PEMCO and their Northwest customer base.

CSSE 14.4 // ULTRASOUND EXAM DATA ROUTER **SPONSOR: PHILIPS MEDICAL SYSTEMS**



SPONSOR LIASONS: Rob Trahms, Earl Canfield, Grant Jorde

FACULTY ADVISOR: Prof. Eric Larson

STUDENT: Anthony Marcheselli, Owen Prigel, Chris Reeder, Tim Reilly

Philips Healthcare produces ultrasound imaging solutions for hospitals around the world. Currently, patients are given DVDs or VHS tapes of their ultrasound exams. For medical professionals, hospitals store ultrasound exams on internal servers that may be difficult to access remotely. Philips Healthcare asked the team to create a web-based interface that allows patients and doctors to view and download the results of ultrasound exams. The team developed an easy-to-use system so that doctors and patients can see the results of ultrasound exams quickly and securely.

CSSE 14.5 // INTERACTOME: EXPLORING SOCIAL CONNECTIONS IN SCIENTIFIC RESEARCH **SPONSOR: SAGE BIONETWORKS**



SPONSOR LIAISONS: Justin Guinney and David Burdick

FACULTY ADVISOR: Prof. Annie Dai

STUDENTS: Nathan Lucyk, Ly Nguyen, James O'Donoghue, Henry Yogman

Cancer researchers are often unaware of similar research conducted elsewhere in the world that would be useful to their own research. Thus, they miss opportunities to collaborate, share discoveries and combine data samples. Sage Bionetworks asked team CSSE 14.5 to create the Interactome app to help researchers collaborate in a more timely and effective manner. The Interactome is a web-based application that links researchers with common research interests, based on similar abstracts and publications. Researchers can use the Interactome to search for and connect with other researchers. Researchers will select abstracts in which they are interested, and the Interactome will perform data analytics (scan abstracts) and provide recommendations of similar abstracts to the original set of abstracts that were selected.

CSSE 14.6 // SOCIAL INTELLIGENCE WORKFLOW MANAGER
SPONSOR: SDL | SOCIAL INTELLIGENCE



SPONSOR LIAISON: Jason Xue

FACULTY ADVISOR: Prof. Adair Dingle

STUDENTS: Devin Anderson, Justin Chu, Amanda Drasnin,
Kai-Ying Tso

SDL wants a tool to automate the workflow from their SM2 social media tool to their newer Customer Commitment Dashboard tool. These two programs were created separately to analyze social data in different ways; however, to use Customer Commitment Dashboard, SDL had to manually transfer data from SM2 and track its progress. SDL wanted these two programs to be better integrated. Our tool automates and tracks the data transfer process, thereby minimizing the amount of time engineers spend managing the workflow. Prior to the implementation of our tools, SDL's customers had to call SDL customer service representatives and wait until engineers could manually update the status of the data transfer process. Our solution allows customers to get faster responses regarding the data transfer status and reduces the amount of time engineers must spend on tracking the data transfer process.



ELECTRICAL AND COMPUTER ENGINEERING



ECE 14.1 // LOAD AND VOLTAGE/VAR MANAGEMENT (LVM) AND ADVISORY PLANS VIA IPAD APPLICATION

SPONSOR: ALSTOM GRID



SPONSOR LIAISON: Allen Chan

FACULTY ADVISOR: Prof. Xusheng Chen

STUDENTS: Alex Grunerud, Nhung Tran, Trevor Velasco, Neil-Patrick Villamora

As one of the industry leaders in power system distribution management software (DMS), ALSTOM Grid aims to implement one of their significant applications in managing power systems, known as Load-Volt/VAR Management (LVM), into an iOS application that is formatted for iPad use. This iOS application allows for customers to remotely monitor and adjust any sudden changes to a regional power grid system via a user-friendly interface. This interface is used as a device to retrieve a specified set of LVM plans on how to alter the system through a streamlined series of applications within ALSTOM Grid's DMS. The iOS application retrieves these LVM plans from a Microsoft SQL Server database, which in turn constantly receives updated plans from the DMS. In order to implement the iOS application, the design team discovered and used a method for enabling the iOS application and SQL database to communicate via native interface software known as FreeTDS. Additionally, they ensured that the data contained within the plans remained consistent while passing through from the DMS to the iOS application.

ECE 14.2 // PROTECTIVE RELAY – PLANT DCS IEC 61850 COMMUNICATION VERIFICATION

SPONSOR: SNC-LAVALIN

SPONSOR LIAISONS: Bryan Brennan, Katherine Gibbons, Britt Teegarden

FACULTY ADVISOR: Prof. Steve Szablya, PE

STUDENTS: Josiah Arteaga, Rashpal Bassi, Patrick Sprenger



Design team ECE 14.2 used the IEC-61850 standard to create an Ethernet link network that connects various protective relays with an Emerson Ovation Plant Distributed Control System (DCS). The IEC-61850 is a communication protocol that provides more efficient exchange of data in power plants and substations. Our team developed a standard list of elements and configuration settings for the protective relays and the DCS. This provides a standardized communication link list that has been thoroughly vetted and tested. The use of Ethernet provides interoperability between devices at a lower cost than the methods currently being used.

ECE 14.3 // COMPARISON OF COMMUNICATION-BASED LINE RELAYING SCHEMES FOR MICROPROCESSOR RELAYS

SPONSOR: SEATTLE CITY LIGHT



SPONSOR LIAISON: Arman Birang

FACULTY ADVISOR: Prof. Robert Heeren

STUDENTS: Weston Cox, Scott Moser, Daniel Wight, Joshua Wu

Seattle City Light (SCL) provides electricity to over 700,000 residents in Seattle and the surrounding metropolitan area. A significant portion of this energy is generated in Western Washington at the Skagit Hydroelectric Project. The transmission line protection at two of these generation facilities has become obsolete and is scheduled for upgrade in 2015 and 2016. The upgrades will be centered on microprocessor-based protective relaying technology, providing a means for fast, secure and dependable protection. SCL commissioned design team ECE 14.3 to research and recommend a communication-based line relaying scheme, communications medium and communications protocol for these upgrades. The team then assisted with AC and DC schematics, relay settings and relay testing, culminating in a formal design basis memorandum which provides a detailed plan of implementation for the upgrade. This project will help maintain power system integrity, ultimately ensuring the delivery of high-quality, reliable power to SCL customers.





ECE 14.4 // MUHURU BAY COMMUNITY MICROGRID SPONSOR: SEATTLE UNIVERSITY



SPONSOR LIAISON: Prof. Steve Szablya, PE

FACULTY ADVISOR: Prof. Steve Szablya, PE

STUDENTS: Patrick Berg, Michael Koppi, Andrew Mewborn, Daniel Nausner

Seattle University asked team ECE 14.4 to design a microgrid system for a 3 kW wind and solar farm, which will be used as a charging station for a rural community and a small, private primary school, Kristy's Cape Academy. This school serves approximately 300 students, many of whom are orphaned due to HIV/AIDS, in Muhuru Bay, Kenya. The project's ultimate goal is to provide community members access to electricity, which will in turn help to improve the developmental outlook of the students and the community. The microgrid system consisted of 1.5 kW of wind and 1.5 kW of solar capacity. Our design used pre-manufactured equipment, and included a complete wiring diagram for the power source, controls and power transmission to a charging station. This will charge over 60 portable battery kits per day and provide power to Kristy's Cape Academy, as well as the headmaster's house. The project also integrated basic telemetry that used the local cellular network, which will provide data back to Seattle University for further research. Enough site information has been gathered to complete this design, and it is likely that it will be implemented in Kenya in the summer of 2014.

ECE 14.5 // EHHDLU TROUBLESHOOTING AID SPONSOR: HONEYWELL

Honeywell

SPONSOR LIAISONS: Sharon Eaglestone, Roger Harper, Sandy Howe-Ryberg, Karim Farraj

FACULTY ADVISOR: Prof. Paul Neudorfer

STUDENTS: Ben Kopietz, Juan Morales, Edward Shwab

The Honeywell Extended Handheld DownLoad Unit (eHHDLU) is used to download data from Honeywell's flight recorders. The eHHDLU is based on the Trimble Nomad handheld computer

and uses a Honeywell proprietary software application. Honeywell receives troubleshooting questions from users when problems occur using the eHDDL or when the unit does not perform as expected. The company asked the team to create an automated troubleshooting aid that customers could use to solve (or to collect more detailed data on) any problems that occur in the use of the eHDDL. The team developed software to provide an interface with Honeywell flight recorders through the eHDDL to assess and repair issues that would otherwise prevent a user from completing a download. The additional software provides users a means to resolve problems related to eHDDL use without the need to contact Honeywell for troubleshooting questions.

ECE 14.6 // LANE CHANGING COLLISION AVOIDANCE SYSTEM

SPONSOR: PACCAR INC.

PACCAR Inc

SPONSOR LIAISON: Mark Fredrickson

FACULTY ADVISOR: Prof. Kevin Lybarger

STUDENTS: Timothy Abbott, Brian Gorman, Lamond Le, Kaleb Loo

PACCAR Inc. (PACCAR) is a multinational manufacturer of medium and heavy duty trucks and truck parts. PACCAR currently offers to outfit trucks with a third-party lateral collision prevention system. While the current solution works, it has a high rate of false positives and is costly. Due to these reasons, PACCAR asked the team to explore alternative systems to detect vehicles in areas of limited visibility. The team implemented several algorithms for detecting vehicles using computer vision. The new system is less expensive and produces fewer false positives than the existing solution. The lane changing collision avoidance system will be integrated into the larger network architecture on PACCAR trucks.



ECE 14.7 // BUSINESS INTELLIGENCE FOR SMART GRID ENERGY DASHBOARD
SPONSOR: CITY INTELLIGENT SYSTEMS, INC.

SPONSOR LIAISONS: Kenji Ushimaru and William Isenberger

FACULTY ADVISOR: Prof. Agnieszka Miguel

STUDENTS: David Collins, Henry Gunawan, Aleksandr Karpitsov



City Intelligent Systems develops software solutions that align local governments and utility companies with the Microsoft CityNext initiative. Currently employing data analysis to improve tax and revenue streams for government administrations, City Intelligent also seeks to push the boundaries on how electric utilities' data can be used to increase efficiency and performance of the current power grid. With the goal of discerning meaningful and useful patterns from historical power outage data and grid loading statistics, the team conducted data analysis and presented the findings in a compelling, interactive software dashboard. By training data mining models based on clustering and association algorithms, the dashboard presents improved grid loading profiles and predictive analysis of future outages.



ECE 14.8 // MICROGRID SIMULATION MODEL AND TOOLS

SPONSOR: PACIFIC NORTHWEST NATIONAL LABORATORY

SPONSOR LIAISON: Kevin Schneider, PE

FACULTY ADVISOR: Prof. Henry Louie

STUDENTS: Derek Gowrylow, Kyle Shoemaker, William Hendershot



Microgrids are a newly popularized power system architecture that are capable of increasing reliability and offering flexibility in system operation. A salient feature of microgrids is the integration of heterogeneous components, such as photovoltaic panels, energy storage and AC and DC loads. It is important to understand the interaction of these diverse components under a wide variety of conditions. Simulation is one important way to gain this understanding, but it requires appropriate models of the components. Pacific Northwest National Lab (PNNL), in association with Oak Ridge National Laboratory, created a framework to develop models of microgrid components that are amenable to simulation tools. PNNL tasked team ECE 14.8 to further test and critique this modeling framework. They used the framework to develop models of various components, and critiqued the modeling framework. The team created models of modified sine wave inverters and portable battery kits.

ECE 14.9 // DATA-LOGGING LAMP
SPONSOR: GRAKON

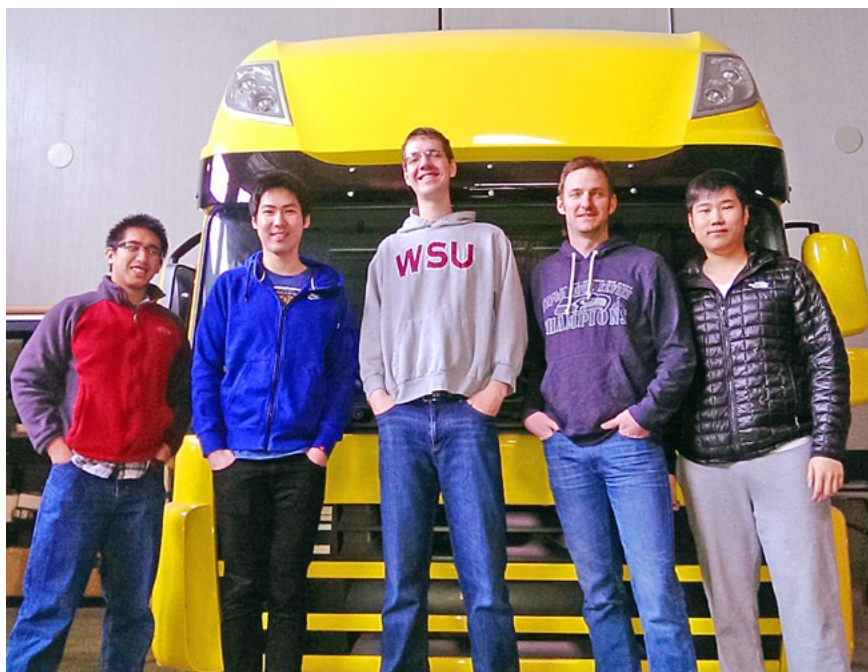
Grakon

SPONSOR LIAISON: Kaustuva Acharya

FACULTY ADVISOR: Prof. Kevin Lybarger

STUDENTS: Jason Bediones, Eric Roberts, Gorby Tjokro, Dai Yu

Grakon specializes in the design and manufacture of advanced lighting systems for aerospace, trucking and automobile manufacturers. Grakon designs and manufactures custom lighting systems based on specifications provided by the vehicle manufacturers and would like to know how the provided specifications compare to actual operational environments. Grakon tasked team ECE 14.9 to take an existing lamp and add sensors to monitor ambient temperature, current and voltage. The team redesigned the lamp by using a programmable microcontroller, which provided the benefit of consolidating lighting control, as well as sensor inclusion. A microSD card was added to the design to store data and provide a means of offloading and reading the data. Grakon now has a device that it can place in a wide variety of vehicles across the globe and that will capture data. These data will also aid the company in future product development.



MECHANICAL ENGINEERING

ME 14.1 // DE-BURR OF CANTEN CUPS

SPONSOR: LIGHTHOUSE FOR THE BLIND, INC.



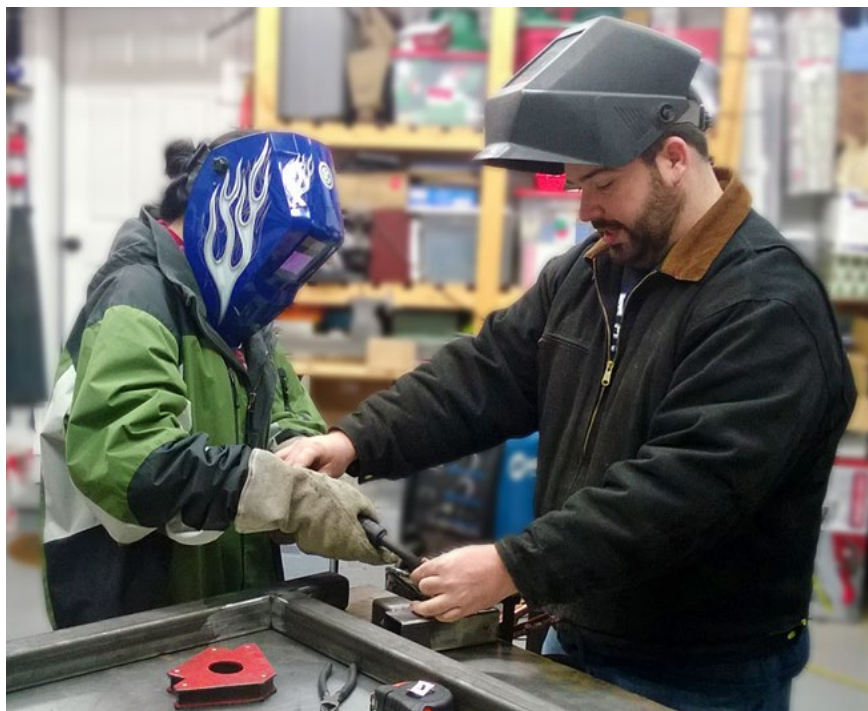
The Lighthouse for the Blind, Inc.

SPONSOR LIAISON: Paul Fletcher

FACULTY ADVISOR: Prof. Greg Mason, PE

STUDENTS: Luisa Dani, Colton Goss, Jeremy Higgins, Nick Kennard

Lighthouse for the Blind is a not-for-profit organization that primarily employs people who are blind or deaf-blind. One of the products Lighthouse produces is a stainless steel canteen cup used by the United States Armed Forces. During the cup forming process, a sharp burr is produced on the edge of the cup. The current process used to remove the burr is costly and inefficient. Lighthouse tasked team ME 14.1 with developing a burr removal process that is more efficient, less costly and safe for a deaf-blind person to operate. The team built and tested a deburring machine based on a three axis Computer Numerical Controlled (CNC) system. The machine uses a spinning abrasive wheel and a pneumatic mechanism that can apply the abrasive at a constant force. Initial estimates indicate that the new machine will save Lighthouse up to \$1,000 per 8-hour shift, during peak production, in deburring costs.





ME 14.2 // DESIGN OF A PORTABLE AND AUTOMATED MERCURY VAPOR DETECTION SYSTEM

SPONSOR: BROOKS RAND LABS

SPONSOR LIAISON: Joel Creswell

FACULTY ADVISOR: Prof. Yen-Lin Han, Prof. Chris Stipe

STUDENTS: Cameron Ellis, Nicholas Miller, Tommy Nguyen, Gretchen Zelle

**BROOKS
RAND**
INSTRUMENTS

Brooks Rand Instruments specializes in the design and manufacture of trace metal detection systems with an emphasis on mercury detection. The company currently manufactures an instrumentation system that measures mercury vapor in air. However, this system requires the user to take samples manually and return them to a laboratory for analysis. The company tasked the team to design a portable system and automate the sample collection and analysis process. The team developed a backpack system, which allows the user to collect and automatically analyze air samples in a field setting. The new system uses a metered air pump to collect and measure air samples as a gold bead trap adsorbs any mercury present in the air. Dual-trap desorption, with Argon as the carrier gas, is then used to concentrate the mercury and prepare it for analysis using cold vapor atomic fluorescence spectroscopy. A microcontroller automates the system, collects data and calculates the concentration of mercury in the air. The new system allows the user to rapidly obtain mercury concentration data and yields results comparable with manual lab analysis.

ME 14.3 // ELECTRIFIED COOLING FAN SPONSOR: KENWORTH TRUCK COMPANY



SPONSOR LIASONS: Stan DeLizo, PE, Ted Scherzinger, PE, Alec Wong, PE, Kevin Oshiro, PE

FACULTY ADVISOR: Prof. Yen-Lin Han

STUDENTS: Adrian David, Mishaël Herrmann, Nicholas Outlaw, Fabrice Pouani, Daniel Reeve, Anthony Shdo

Kenworth Truck Company, a subdivision of PACCAR, specializes in the design and manufacture of commercial semi-trucks in the Class 5 to Class 8 series, which are built to carry loads greater than 33,000 pounds. These loads cause the engine to generate a large amount of heat that needs to be expelled. Currently, these trucks use a fan mechanically coupled to the engine to provide the required cooling. Kenworth asked the team to research the viability of implementing an electric cooling system with the goal of reducing parasitic losses caused by the mechanically-driven fan. This would ultimately lead to a reduction in fuel consumption and an increase in system efficiency. Through extensive research, the team designed a multi-fan array, which consists of nine smaller electric fans, to replace the larger mechanical fan in the current system. A control system is designed to monitor the temperature changes of the radiator coolant. If the coolant temperature increases to a certain level at a specific location, the corresponding fan will be turned on to provide the required cooling. The fan array designed by the team would be capable of achieving the required heat rejection rate and improving fuel economy.

ME 14.4 // UNIVERSAL MOUNT FOR XBOX ONE KINECT SPONSOR: MICROSOFT



SPONSOR LIAISON: Joel Jacobs

ADVISORS: Prof. Frank Shih, Prof. Jonathan Hadley

STUDENTS: Adam Frank, Austin McAboy, Jonathan Mey, Tyler Shelton

Microsoft's Xbox One Kinect is a state-of-the-art peripheral motion sensing device that has many applications, including the use in new generation gaming. Currently, there are no available mounts that allow for both TV and wall attachment of the Xbox One Kinect. The goal of the project was to develop various mounting devices for the Kinect, allowing it to be mounted to a range of TVs or to a standard wall. By analyzing user needs and design requirements, the team went through the process of envisioning potential mounting solutions, followed by prototyping and testing to lead to the final three optimized devices. All three devices feature mechanisms that aid in stabilizing the mounted sensor to a TV or wall. The designs of these devices complement the aesthetics of the Kinect and meet criteria on the stability of the device in operation, universal TV application and ease of installation for the intended user. The team also accounted for the process constraints and economic factors found in high volume manufacturing to ensure each design is as close to production as possible.



ME 14.5 // QUICK ATTACH CLEVIS AND ADJUSTABLE TIE ROD
SPONSOR: THE BOEING COMPANY



SPONSOR LIAISON: Aaron J. Pederson

FACULTY ADVISOR: Prof. Bob Cornwell

STUDENTS: Sean Blechschmidt, Steven Gose, Aaron Mendez, Alberto Valdiviez

The Boeing Company is in the process of developing the next generations of 777 and 787 commercial passenger aircraft. The Boeing Interiors Responsibility Center asked team ME 14.5 to work on two components to accelerate aircraft interior assembly and reconfiguration operations: the Quick Attach Clevis and the Advanced Adjustable Tie Rod. The goal of redesigning both components is to meet the design objectives with no impact on performance and minimal increase in weight relative to the current designs. For the Quick Attach Clevis, the team designed a mechanism for attachment of overhead stowage bins to reduce both the installation time and the number of mechanics required. For the Adjustable Tie Rod, the team designed an adjustment mechanism that allows Boeing to reduce the number of tie rods that must be kept in stock for installation. The team's designs will reduce both inventory costs and increase flexibility during interiors installation.



ME 14.6 // REACTIVE AIRCRAFT PARTITION MOUNTING SYSTEM

SPONSOR: THE BOEING COMPANY



SPONSOR LIAISON: Nathaniel Cuddy

FACULTY ADVISOR: Prof. William Baratuci

STUDENTS: Kevin Hulik, Thomas Kackley, William Koch, Glen Miller

The Boeing Company manufactures aircraft that have partitions dividing classes and passenger/crew areas. In the event of an emergency landing condition, these partitions can deflect forward as much as 4 inches at mid span. According to Boeing and FAA regulations, this space must be kept clear. Boeing tasked the team to redesign the upper attachment for the partition and implement a reactive mounting system, which would reduce forward deflection of the partition at midspan. Reducing the deflection would allow extra space in the aircraft design, which could allow for larger crew areas, more passenger area or even an extra row of seats if the aircraft had enough partitions. This system will only act on the partition in the case of an emergency landing condition. The team chose to implement a piston system, which will push the top of the partition aft, effectively reducing forward deflection in such conditions.

ME 14.7 // CARBON FIBER RE-SPOOLING SYSTEM

SPONSOR: ELECTROIMPACT



SPONSOR LIAISON: Brock Jahner

FACULTY ADVISOR: Prof. Frank Shih

STUDENTS: Caleb Bowman, Marie Grieshaber, Trevor Umbinetti, Jenny Yin

Electroimpact specializes in creating automated solutions for their aerospace customers. They have created one solution called the Automated Fiber Placement (AFP) head that uses 16 carbon fiber spools to layer carbon fiber on project surfaces. However, each carbon fiber spool depletes at a different rate, causing partial spools to accumulate and go to waste due to the inability to re-use them on the head. The company tasked the team to design and build a prototype of a carbon fiber re-spooling system. The team's prototype system takes partially used spools of carbon fiber to create new spools that can be reused. This is done by re-winding the carbon fiber using a transverse wind, splicing carbon fiber together, replacing the backing that is on the carbon fiber and marking the splices. This system will allow Electroimpact and their customers to save upwards of 50 to 100 dollars per pound of carbon fiber that would otherwise have been considered waste.

ME 14.8 // BELLARMINE CENTRAL HOT WATER SYSTEM COMPREHENSIVE PLAN

SPONSOR: SEATTLE UNIVERSITY AND MCKINSTRY CO.



SPONSOR LIAISONS: Cal Ihler, Kavik Frol, Kristina Sing, Bryan Morris, Matt Wegworth

FACULTY ADVISOR: Prof. Keith Elder, PE

STUDENTS: Catherine Corrales, Jason Huynh, Jamie Li, Eric Pak

The Seattle University campus currently has eight non-condensing boilers supplying heating and domestic hot water to four buildings on the Seattle University campus. The oldest boilers and domestic hot water storage tanks are nearing the end of their useful lives; therefore Seattle University Facilities asked the team to work in collaboration with the McKinstry Co. to replace the storage tanks, isolate the domestic hot water systems in two of the buildings and upgrade

two of the non-condensing boilers to condensing boilers. The current system infrastructure was evaluated to gain understanding of the boiler plant piping network, equipment and operation. Using energy analysis techniques, multiple methods to determine project building heating and hot water loads and cost analysis methods, the team conducted an evaluation of the overall effectiveness of the proposed system compared to the current system. Local building codes and industry standards were considered in the solution development of this project. This upgrade will greatly improve Seattle University's infrastructure while supporting Seattle University's commitment to sustainability.

ME 14.9 // UPGRADE LONGMIRE ROADS GARAGE FOR HIGHER ENERGY EFFICIENCY

SPONSOR: NATIONAL PARK SERVICE

SPONSOR LIAISONS: Joseph Balachowski and James Fuller

FACTULTY ADVISOR: Prof. Keith Elder, PE

STUDENTS: Scott DiGiorgio, David Elliott, Shane Fulwiler, Alen Hajdarovic



Longmire serves as the operations center for Mount Rainier National Park, and is crucial for the safety and enjoyment of all visitors. The Longmire Roads Garage houses snowplows and equipment, and it was constructed in the 1930s when snowplowing equipment was smaller and energy efficiency was not a concern. The National Park Service tasked the team to conduct an energy and functionality analysis of the current garage, seeking a recommendation as to whether they should retrofit the existing structure or build a new garage. Based on the team's analysis, the Park determined it needs a new building, which will increase functionality and operator safety and reduce environmental impact. The fuel used to operate the boiler will be switched from diesel to propane, which is less expensive, and promises to reduce the carbon footprint of the building. The team made additional recommendations for building envelope improvements, a higher efficiency boiler, heating and a ventilation system. Finally, the team provided the National Park Service with a detailed energy model of all major strategies considered.

ME 14.10 // ARTICULATING SPOUT

SPONSOR: HINDS-BOCK CORP.

SPONSOR LIAISON: Patrick Yumang and

Derek Pagenkopf

FACTULTY ADVISOR: Prof. William Baratuci

STUDENTS: Jack Cramer, David Funnell, Alex Kinsman, Erin Sheehan



Hinds-Bock specializes in the custom design, manufacture and sale of commercial food dispensing systems. The company had previously developed and prototyped a dispensing spout assembly; however, due to its weight and complexity, it was too difficult and time-consuming to disassemble for cleaning. Hinds-Bock's prototype consisted of two main components: a dispensing spout and a lowering mechanism. The team was asked to redesign the prototype to make it more compact, while making disassembly and reassembly easier as well. This goal was achieved by redesigning the two components and integrating them into an all-in-one assembly using one central pipe. The team modeled and tested their design in SolidWorks, and Hinds-Bock machined the final prototype. The redesigned assembly contains fewer parts and weighs less, which significantly decreases the time required for cleaning.

MASTERS IN SOFTWARE ENGINEERING

MSE 14.1 // SAVORY FRAMEWORK **SPONSOR: ASTRONICS**



SPONSOR LIAISON: Scott Kinnear

FACULTY ADVISOR: Prof. Jerry Williams

STUDENTS: Ziyad Alsaeed, Michael Barton, Tracy Davies, Brent Henriksen

Astronics CorePower smart-grid eliminates hundreds of miles of redundant wiring in modern aircraft. CorePower's multi-purpose behavior is driven by its network of smart devices that each monitor system properties and react to external commands. The system can enter more than 130,000 possible states during flight time. These system designs are very complex and all system configurations must be reviewed to ensure safety, as mandated by FAA regulations. Astronics wants to use a computer-driven simulation technology for expediting large system design analysis to assist with dealing with these complex designs. Team MSE 14.1 was formed to investigate and architect a solution. They built a tool called SAVORY, which is an extensible framework that simplifies device representation and connectivity and integrates existing NL5 simulation technology into a cohesive interactive environment. SAVORY will be used to simplify the experience of constructing and integrating larger power systems. Rather than building from the ground up, the team's system allows the end user to leverage SAVORY to build systems with pre-built devices already containing their equivalent NL5-complete representations. This system will make it much simpler to construct complex designs using lower level SAVORY components.

MSE 14.2 // COSTCO TEAM CONCERT **SPONSOR: COSTCO**



SPONSOR LIAISON: Shrikant Palkar

FACULTY ADVISOR: Prof. Roshanak Roshandel

STUDENTS: Akzhol Abdukhaliev, David Chapman, Priya Mutha, Miguel Sevilla

Costco Wholesale Corporation is a membership-only warehouse club that provides consumers with a wide selection of merchandise. Costco currently uses IBM's Rational Team Concert (RTC) as their collaborative lifecycle management desktop solution to manage the various projects across the enterprise. RTC allows the teams to collaborate using integrated iteration planning, work item management, and it also provides dashboards and reporting. The company asked the team to design a mobile solution that would provide an enhanced view of current RTC data, as well as aggregate and display new information. The team built an app for the iPad that provides a snapshot view across project and tasks. The app provides a means to access and view RTC data quickly and in a visually enhanced format. Having this information on hand will assist management in making informed decisions based on the health of the projects.

MSE 14.3 // ENERGY RESOURCE ANALYTICS
SPONSOR: SNOHOMISH COUNTY PUBLIC UTILITY DISTRICT



SPONSOR LIAISON: Doris Payne

FACULTY ADVISOR: Prof. Michael Koenig

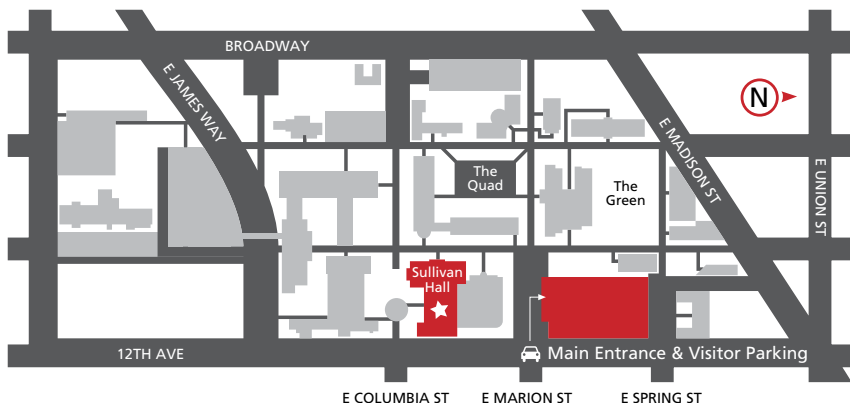
STUDENTS: Bhakti Inamdar, Samyukta Mandavilli, Seth Ringling, Shruti Shah

Snohomish Public Utility District (PUD) is a power company that provides power to the residents of Snohomish County. One of the challenges the company faces is how to obtain power and how to ensure that they are always able to meet the power needs of their customers without generating waste. The Power Scheduling Group at Snohomish PUD is tasked with this difficult prospect. To make the best possible decisions when sourcing or selling power, this group needs to access a large amount of data that is shown in a sensible way for their fast-paced needs. Team MSE 14.3 constructed a robust data warehousing solution by amalgamating several large databases. The warehousing solution provides a single, coherent view of the important information needed by the Power Scheduling Group to make critical decisions for sourcing or selling power.



THANK YOU TO OUR SPONSORS // 1987 - 2014

- A.K. Gordon & Associates
- Adobe Systems, Inc.
- Alliant Techsystems
- ⇒ Alstom (formerly AREVA T&D)
- Amazon
- AMEC
- Appia Engineering Consultants
- Appian Graphics
- Applied Microsystems Corporation
- ARIS Corporation
- Artisan Instruments
- Atigeo
- Astronics
- AVTECH Corporation
- Bass Educational Services
- Better Lifestyles, Inc.
- Bioalgene
- ⇒ The Boeing Company
- Brooks Rand
- CDADIC (Design Analog-Digital Integrated Circuit)
- Cingular Wireless
- Citrix Systems, Inc.
- City of Seattle
- City Intelligent Systems, Inc.
- Consolidated Metco
- Costco
- Coughlin Porter Lundeen
- Cray
- Cybergroup, Inc.
- Data I/O Corporation
- David Evans and Associates Inc.
- David Taylor Research Center
- Des Moines, City of
- DevDac
- ⇒ Duet Cascade (formerly Cascade Design)
- ELDEC Corporation
- Electroimpact
- Emerald City Rotary Club
- Enchanted Learning
- Engineered Software, Inc.
- Engineers Without Borders
- Flow
- Fluke Corporation
- Fred Hutchinson Cancer Research Center
- Friends of Blackman Lake
- FSI
- Grakon
- Group Four
- GT Development Corporation
- Harris Group Inc.
- Harrison Comfort Footwear
- HDR Engineering
- Herrera Environmental Consultants
- Hinds-Bock
- Hewlett-Packard Company
- ⇒ Honeywell
- IEEE
- Industrial Revolution
- Ingersoll-Rand
- Intelligent Results
- K2 Corporation
- Kennedy/Jenks Consultants
- King County
- King Street Coop Pre-School
- Leadership Advancement International
- Magnusson Klemencic Associates, Inc.
- Management Assistance and Concepts Corporation
- MC Electric Vehicle
- McKinstry Co.
- Medtronic Physio-Control
- Mercent Corp.
- Microscan Systems Incorporated
- Microsoft
- National Bureau of Asian Research
- National Park Service
- Neighborhood House
- Nesting Bird Yurt Company
- Noetix
- Nordstrom
- Nova Ray
- Nutraceuticals, Inc.
- Octaform
- ⇒ PACCAR/Kenworth Truck Company
- Pacific Northwest National Laboratory
- PACLAND
- ⇒ Parsons Brinckerhoff
- PATH
- PEMCO
- Philips Healthcare
- Photon Machines
- Pierce County
- Port of Seattle
- Potters for Peace
- Pratt & Whitney
- PSF Mechanical
- ⇒ Puget Sound Energy
- ⇒ Qwest Communications
- Rabanco, Ltd
- Regence BlueShield
- REI
- Robbins Company, The
- Sage Bionetworks
- Saint James Cathedral
- Schweitzer Engineering Laboratories
- Scout Analytics
- ⇒ Seattle City Light
- SDL | Social Intelligence
- Seattle Lighthouse for the Blind
- Seattle Public Utilities
- Seattle University
- Siemens Medical Solutions USA, Inc.
- SignalSet
- SNC Lavalin
- Snohomish County Public Works
- Snohomish County PUD
- Solution Recovery Services (SRS)
- Sound Transit
- Spinoza Technology, LLC
- SRAM Corporation
- SunGard Collegis
- SvR Design Company
- Terabeam
- Tetra Tech KCM
- The Other Roadside Attraction
- Tinnea & Associates
- Triad Associates
- TSI
- Two Degrees Consulting
- Univar USA Inc.
- Universal Avionics System Corporation
- University of Washington
- US Army Corps of Engineers
- US Bureau of Reclamation
- US Coast Guard
- US Forest Service
- US Public Health Service
- Valberg Corporation
- Verizon
- Vietnam Veterans of America
- Washington Mutual
- Washington Publishing Company
- Washington State Department of Licensing
- Washington State Department of Transportation
- Washington State Ferries
- Waste Management, Inc
- Waterfront Construction
- Wave Consulting Group
- Wellness by Design
- Westinghouse Hanford Company
- Weyerhaeuser Company
- Wilapa Hills Farmstead Cheese
- Wire Dynamix
- WISDM Corporation
- World Bicycle Relief
- Xilinx, Inc.
- Zetec
- ⇒ SPONSORED 10+ PROJECTS
- ⇒ SPONSORED 20+ PROJECTS



DIRECTIONS

FROM THE NORTH

- Head South on I-5
- Take exit 165A to James Street
- Left onto James Street
- Left onto 12th Avenue
- Left onto East Marion Street

FROM THE SOUTH

- Head north on I-5
- Take exit 164A to James Street
- Right onto James Street
- Left onto 12th Avenue
- Left onto East Marion Street

SEATTLEU